

**TESTIMONY OF DR. LUCIUS ELDREDGE OF THE
DEPARTMENT OF NATURAL SCIENCE, BISHOP MUSEUM, HAWAII
BEFORE THE HOUSE RESOURCES COMMITTEE
SUBCOMMITTEE ON FISHERIES CONSERVATION, WILDLIFE, AND OCEANS,
SUBCOMMITTEE ON FORESTS AND FOREST HEALTH, AND
SUBCOMMITTEE ON NATIONAL PARKS, RECREATION, AND PUBLIC LANDS**

March 14, 2002

Mr. Chairman and Members of the Committee:

Thank you for the opportunity to present testimony on H.R. 3558 "Species protection and conservation of the environment".

Please let me introduce myself: I am Dr. Lu Eldredge. I have lived in the Pacific islands of Oahu and Guam for more than 40 years and have observed many changes in the environment during these times. First arriving in Hawaii in August 1959, I attended the University of Hawaii where I received a Ph.D. in Zoology in 1965. Following that I was a professor at the University of Guam for 22 years. I assisted in the development of the University Marine Laboratory and was very active with the South Pacific Regional Environment Programme, which allowed me to participate in many activities throughout the Pacific islands. I was a member of the SPREP Invasive species advisory group and participated in the development of SPREP's invasive species technical review and regional strategy. I have been at the Bishop Museum in Honolulu for the past 13 years. Bishop Museum has been the foremost museum in the Pacific during its 113 years, and with its 24 million specimens and objects contains one of the largest collections of Hawaiian and Pacific material in the world. As a leader in biodiversity and conservation in the region, the Museum's staff includes a major core group, studying nonindigenous and invasive species throughout the Pacific.

The Hawaiian Islands, by virtue of their geographic isolation, rich volcanic soils, and enormous topographic and climatic diversity, have produced a highly endemic flora and fauna, which includes many of the world's outstanding examples of adaptive radiation. The biota includes more than 23,000 species. Hawaii accounts for only about 0.2% of the land area of the United States, but has 31% of the nation's endangered species and 42% of its endangered birds. Of the 1072 species of native flowering plants, 73 are down to about 20 or fewer individuals in the wild, and nine are down to one. Nearly one-third of the more than 8000 insect species are nonnative. Almost 75 % of the historically documented extinctions of plants and animals in the United States have occurred in Hawaii. Not only the "extinction capital of the world", the Hawaiian Islands are also the "introduced species capital of the world" with 5047 species of the total of 23,150 being introduced. Approximately 22% of the islands' biota is nonnative.

These figures have been compiled through the activities of the Hawaii Biological Survey at the Bishop Museum. The Hawaii Biological Survey was established by the Hawaii State Legislature in 1992 to develop, maintain, and disseminate information on all the biota of the Hawaiian Islands. The Bishop Museum is also coordinating activities in the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve through assembling information on the literature and specimens from the Northwestern Hawaiian Islands and will be

establishing standardized monitoring techniques as well as convening a symposium on past and present research activities to develop priorities for future study.

Similar figures are not known for the other U.S.-affiliated islands in the Pacific. On Guam approximately 63% of the flowering plants are thought to be nonnative. All these islands need much more study.

The problems of nonnative land plants and animals are fairly well documented. For more than 20 years I watched the brown tree snake spread on Guam from the harbor area northward. When we first arrived on Guam, the Guam rails would carry out their courtship dances in our childrens' sandbox, and the cardinal honeyeater would sip the red hibiscus just outside the front door. Now these species are extinct, at least in the wild, having been preyed upon by the brown tree snake.

Many other examples could be enumerated. The aquatic (freshwater and marine) ecosystems have not shared in this extensive study. In U.S. mainland freshwaters the zebra mussels, purple loosestrife, round blenny, and others have attracted much attention and much research has been carried out on them. In the Pacific islands very little is known about nonnative freshwater species. Most fish introductions have been the result of aquaculture, either by escape or intentional release. A total of 86 fish species have been introduced into fresh (and some brackish) waters in the Pacific and Hawaiian Islands; not all have been successful. Seventy-two species have been introduced to the Hawaiian Islands, 59 have been observed or established since 1982. Twenty of these 59 species resulted from aquarium releases. New Guinea has received 30 species with 19 being considered established. Guam and Fiji each have 24 introduced species; 17 species established on Guam and 12 species established in Fiji.

The flora and fauna of the islands' coastal ecosystems is the least known. Nonnative marine species are more difficult to distinguish. Through established criteria--sudden appearance, association with nonnative species in artificial (harbors, docks, pilings, etc.) sites, disjunct distributions (i.e., Norway, Panama Canal, Pearl Harbor)--their status can be determined as either introduced or cryptogenic (not demonstratively native or introduced).

The majority of marine species are dispersed by ships either in ballast water or attached to the hull, anchors, chains, or to floating cargo as fouling organisms. Fouling organisms are also attached to drilling platforms, dry docks, buoys, and so forth. Fisheries and marine aquaculture, including stock enhancement, are major pathways either by escape or intentional release. The ornamental pet industry and public aquaria have been responsible for accidental or intentional releases.

Numbers of nonnative marine species in Hawaii include 343 species--287 invertebrates, 24 algae, 20 fish, and 12 flowering plants. Two hundred twelve or 90% are thought to have arrived through hull fouling. The majority of species had their origin in the western Indo-Pacific and Philippines; the origins of many are unknown or worldwide in distribution. More than 10% have originated in the Caribbean region.

In Hawaii, five species of marine algae have become very invasive. The first to be recognized arrived on the hull of a cement barge from the Philippine Islands in 1950. This species, *Acanthophora spicifera*, has displaced native species. *Hypnea musciformis*, intentionally introduced for commercial reasons has been recorded to accumulate beach drift of 20,000 pounds per week at coastal Maui. Two additional species were deliberately introduced for potential commercial development and currently cover much of the coral reef in Kaneohe Bay. *Gracilaria salicornia* has invaded several reef areas overgrowing most of the reefs at Waikiki. All of these species are undergoing a community phase shift overgrowing a complex reef community and changing it to a single species algal community. Such rapid shifts (on the order of months) further

demonstrates that these ecosystems are highly susceptible to changing physical and biological conditions.

Approximately 20 species of marine fish are nonnative to Hawaiian waters. Three species, intentionally introduced from French Polynesia in the 1950s for stock enhancement, have become well established and may be competing with local native fishes. Salt-tolerant tilapia is feeding on coral polyps.

In harbors and embayments in Hawaii the percentage of nonnative species increases greatly--23% for Pearl Harbor, 17% for Honolulu Harbor, but 1.5% and 1.0% for Midway Island and for Kahoolawe, respectively. Current studies in Kaneohe Bay and Waikiki show about 7% nonnative species. Percentage figures can be misleading, since an example like the zebra mussel, less than 1% of the fauna of the Great Lakes, has caused the greatest amount of damage.

The only comparative figures are for Guam where about 6.7% of the total number of invertebrates surveyed are considered to be nonnative.

In order to further the directives of H.R. 3558, more studies need to be conducted in the coastal areas of the United States. There is a great need to further understand the pathways and dispersal mechanisms of nonnative species. The first line of defense is prevention, followed by early detection and rapid response. Through these the coastal waters of the United States be able to keep the introductions of nonnative species to a minimum.

I fully support all the components of H.R. 3558. All these activities fall under the purview of the Hawaii Biological Survey at Bishop Museum and its information gathering and dissemination activities, and its activities with the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve.

Thank you, Chairman and Members of the Committee.

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